Review of the Australian Dipteridaceae

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A critical examination is made of the available fossil fern specimens included in the family Dipteridaceae from Australian collections. All valid fossil species from Australia are reviewed, but extant species are not considered.

Poorly-described species are redescribed, and illustrated, with lectotypes selected where necessary. *Thaumatopteris shirleyi* sp. nov. is erected, being the first record of the genus from Australia; doubtfully, *Clathropteris* is cited for the first time.

The species *Dictyophyllum rugosum, D. obtusilobum?* and *Hausmannia buchii* are shown to be absent from Australia.

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INTRODUCTION

Other than in South America, the Gondwana record of fossil members of the fern family Dipteridaceae seems to be a meagre one. Very little is known of the family from South Africa and India, and only a few ill-defined species had been described many years ago from Australasia. Considering the relative wealth of species and specimens from South America this always seemed rather strange to me. Thus, while studying Triassic plants, and having found some good specimens of these ferns, I decided to review the whole group from Australia and New Zealand without restricting it to Triassic representatives.

This contribution is to clarify some names, to revalidate and redescribe some poorly known but sound species and to describe the recently found *Thaumatopteris shirleyi* sp. nov. A list of all references to fossil Dipteridaceae was compiled, and after critical examination of the specimens themselves, many were excluded and some others were re-identified. The resulting list of taxa, here considered valid, comprises seven species included in three genera, and the doubtful presence of a fourth genus. Fortunately most of the original specimens could be located in museum collections, mainly in Queensland, therefore lectotypes and paratypes could be selected and designated. I did not see New Zealand material.

Repositories of specimens are abbreviated as follows:

GSQ = Geological Survey of Queensland, Brisbane
MUDG = Department of Geology and Palaeontology, University of Melbourne, Melbourne
QM = Queensland Museum, Brisbane
SUP = Department of Geology and Geophysics, University of Sydney, Sydney
UQ = Department of Geology and Mineralogy, University of Queensland, Brisbane

SYSTEMATIC REVIEW

Previous Records of Australasian Fossil Dipteridaceae

The following list is compiled from all literature available to me in which identification of actual specimens is made:

Original citation	*Source*	*Present status*
1. *Dictyophyllum bremerense*	Shirley, 1898	*D. bremerense*
2. *Dictyophyllum rugosum*	Walkom, 1917	*D. bremerense*
3. *Dictyophyllum davidi*	Walkom, 1917	*D. davidii*
4. *Dictyophyllum acutilobum*	Arber, 1917	*D. acutilobum*
5. *Dictyophyllum obtusilobum?*	Arber, 1917	*D.* sp. cf. *D. acutilobum*
6. *Hausmannia buchii*	Walkom, 1917	not Dipteridaceae
7. *?Dictyophyllum* sp.	Walkom, 1919	not Dipteridaceae
8. *Dictyophyllum rugosum*	Walkom, 1924	*D. davidii*
9. *Hausmannia wilkinsi*	Walkom, 1928	*H. wilkinsii*
10. *Dictyophyllum bremerense*	Jones and de Jersey, 1947	*D. bremerense*
11. *Dictyophyllum* sp. 1	Jones and de Jersey, 1947	not Dipteridaceae
12. *Dictyophyllum* ? sp. 2	Jones and de Jersey, 1947	not Dipteridaceae
13. *Dictyophyllum ? davidi*	Jones, 1948	not Dipteridaceae
14. *Dictyophyllum ? rugosum*	Hill, 1951	*D. davidii*
15. *Dictyophyllum bremerense*	Derrington, 1954	*D. davidii*
16. *Hausmannia* ? sp.	White, 1961	*H. (P.)* sp. cf. *H. (P.) deferrariisii*
17. *Hausmannia (Protorhipis)* sp.	Hill et al.	*H. (P.)* sp. cf. *H. (P.) deferrariisii*
18. *Hausmannia* sp.	White, 1966	*H. (P.)* sp. cf. *H. (P.) deferrariisii*
19. *Hausmannia wilkinsi*	White, 1967	*H.* sp. cf. *H. wilkinsii*
20. *Hausmannia* sp.	Douglas, 1969	*H. bulbaformis*
21. *Dictyophyllum* sp. cf. *D. ellenbergi*	White, 1969	*D. bremerense*
22. *Hausmannia wilkinsi*	White, 1972	*H.* sp. cf. *H. wilkinsii*
23. *Hausmannia* sp. cf. *H. deferrariisii*	Gould, 1974	*H. (P.)* sp. cf. *H. (P.) deferrariisii*
24. *Hausmannia* sp.	Gould, 1975	*H. (P.) sp. cf. H. (P.) deferrariisii*
25. *Hausmannia bulbaformis*	Douglas, 1973	*H. bulbaformis*

From the foregoing list, apart from the misidentified species which have been placed in synonymy, the following names are rejected or excluded from the Australasian Dipteridaceae:

5. *D. obtusilobum*? (Arber, 1917) : this doubtful fragment most probably is a small bit of *D. acutilobum* as Arber himself expressed originally.
6. *H. buchii* (Walkom, 1917) : this is a fragment of a fossil leaf with no visible margin at all. The veins dichotomize, but do not show traces of the anastomosing network of the Dipteridaceae. It is excluded from the record.
7. ? *Dictyophyllum* sp. (Walkom, 1919) : this is a fragmentary specimen which does not show any veins or other detail except its outline. It is improbable that it belongs to the Dipteridaceae.

11. and 12. *Dictyophyllum* sp. *1* and *Dictyophyllum?* sp. *2* (Jones and de Jersey, 1947) : two small fragments which do not show any trace of venation and are incomplete; they are excluded from the record.

13. *Dictyophyllum? davidi* (Jones, 1948) : another fragmentary specimen which only very vaguely reminds one of *Dictyophyllum*; a mid-vein and some lateral veins can be distinguished, but the fragment more probably is a portion of *Dicroidium* sp.

Specimens attributed to other species are quoted either in the synonymy or in the respective discussion below, according to the degree of confidence with which they are regarded as belonging to a particular species.

The following taxa stand as valid:

Dictyophyllum bremerense Shirley
Dictyophyllum davidii Walkom

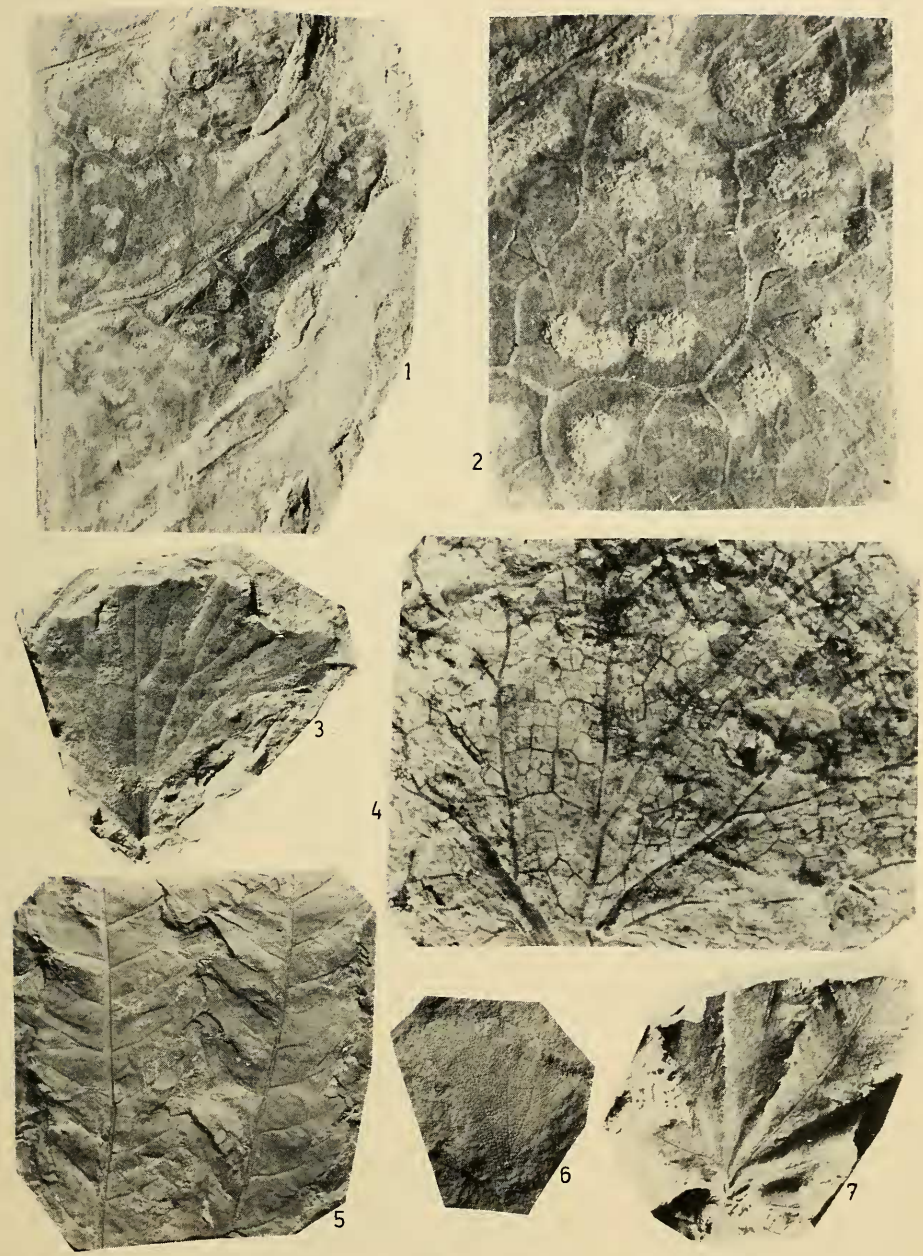

Fig. 1. 1, 2 — *Dictyophyllum bremerense* Shirley, 1898 (1) UQ F64068 ×2⅓; (2) UQ F64068 ×8. 3 — *Hausmannia wilkinsii* Walkom, 1928 GSQ F1943b ×1⅔. 4 — *Clathropteris* sp. UQ F23071 ×1⅓. 5 — *Dictyophyllum bremerense* Shirley, 1898 SUP 20007b ×1. 6 — *Hausmannia (Protorhipis)* sp. cf. *H. (P.) deferrariisii* Feruglio, 1937 Bureau of Mineral Resources, Canberra, specimen F22699, from Helen Springs, Northern Territory (photo kindly supplied by Mrs M. E. White) ×⅔. 7 — *Dictophyllum davidii* Walkom, 1917 GSQ F165 Holotype ×⅔.

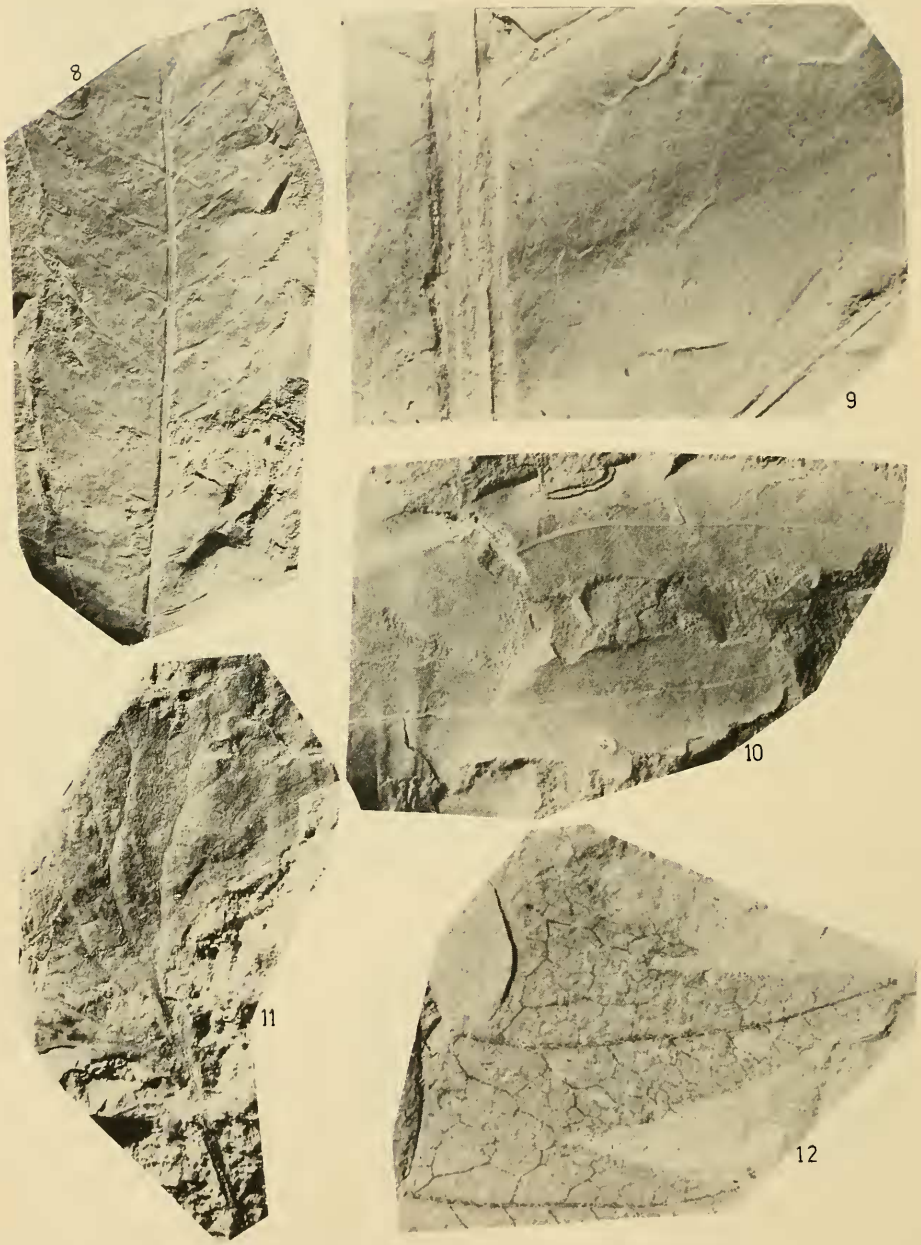

Fig. 2. **8** — *Dictyophyllum bremerense* Shirley, 1898 GSQ F12041 ×1⅓. **9, 10** — *Thaumatopteris shirleyi* n. sp. (**9**) UQ F64280 ×3½; (**10**) No. 2995 (CTES-PB, Argentina) ×2. **11** — *Hausmannia wilkinsii* Walkom, 1928 GSQ F8857 ×2⅔. **12** — *Dictyophyllum davidii* Walkom UQ F48643 ×2.

Dictyophyllum acutilobum (Braun) Schenk
Thaumatopteris shirleyi n. sp.
Hausmannia (Hausmannia ?) wilkinsii Walkom
Hausmannia (Protorhipis) sp. cf. *H. (P.) deferrariisii* Feruglio
Hausmannia (Hausmannia) bulbaformis Douglas
cf. *Clathropteris* sp.

Systematic Palaeobotany

Dictyophyllum bremerense Shirley, 1898
Fig. 1. 1 ,2, 5; Fig. 2. 8; Fig. 3. 1-8.

1898, *Dictyophyllum bremerense* Shirley, *Geol. Surv. Queensl., Publ.* 128: 25, pl. 13, figs 2a/b.
1917, *Dictyophyllum rugosum* Walkom, *Geol. Surv. Queensl., Publ.* 257: 9 pl. 4, fig. 3; pl. 6, fig. 4B; pl. 9, fig. 3.
1947, *Dictyophyllum bremerense* Shirley, *in* Jones & de Jersey, *Univ. Queensland., Pap. Dept. Geol.* 3 (3) : 13; pl. 1, fig. 6; pl. 4, fig. 1b.

Description: Frond palmate (?) with at least seven large pinnae united at the base, and free apically. Free parts of pinnae up to 100 mm long, probably longer, 50 mm wide, rather pinnatifid.

Midrib of pinnae strong and straight; second order lateral veins (the midvein of each "pinnule") arising at 60°, slightly falcate (or apically, concavely arched), reaching the apex of each "pinnule".

"Pinnules" generally falcate, their free portions up to 20 mm long, by 8-9 mm wide basally; apex is generally acute, both margins strongly curved. Distance along midrib between where lateral, second order veins arise is variable, from 6-7 mm to 15-17 mm.

Third order veins (second order lateral veins) arise at 60°-70°, then by successive dichotomous divisions form a network of somewhat elongated, rectangular to polygonal meshes. The highest order meshes are 4-5 mm diameter, and, when elongated, their longest axis lies parallel to the second order veins. From the second order veins, smaller ones of successively higher orders are given off, which themselves form smaller meshes of successively higher orders. The meshes are polygonal, 4-7 sided, with the smallest, highest order, measuring about 0.5 mm diameter. Most higher order meshes are elongated, and tend to be arranged with their longest axis parallel to the second order veins. Venation is similar throughout the lamina.

Fertile specimens are rare, but some show sporangia arranged in "sori" (?) either along lateral veins of second order as elongated bodies 7-8 mm long and 1 mm wide (Fig. 3. 4) or/and distributed randomly on the lamina as oval or rounded bodies 2-3 mm diameter (Fig 3. 4, 7). The shape of these "sori" (Fig. 3. 5) is not clear as all available impressions are from the upper surface, and it is possible that the sporangia are distributed evenly or in irregular patches over the whole lamina.

Individual sporangia are indistinct, they are about 0.05 mm in diameter. An annulus is faintly visible in some.

Discussion: When Shirley erected this species, there were few others to compare it with. Subsequent authors, other than Jones & de Jersey (1947), have ignored it. No more recently erected species are synonymous with it although it is quite similar to *D. tenuifolium* Stipanicic & Menendez, and *D. ellenbergi* Fabre & Greber, and less similar to *D. davidii* Walkom and *D. acutilobum* (Braun) Schenk. All but the last are Gondwanan species, and it is felt that they form a natural, closely related group.

Material Studied: Lectotype: GSQ F 166a (here designated), figured by Shirley

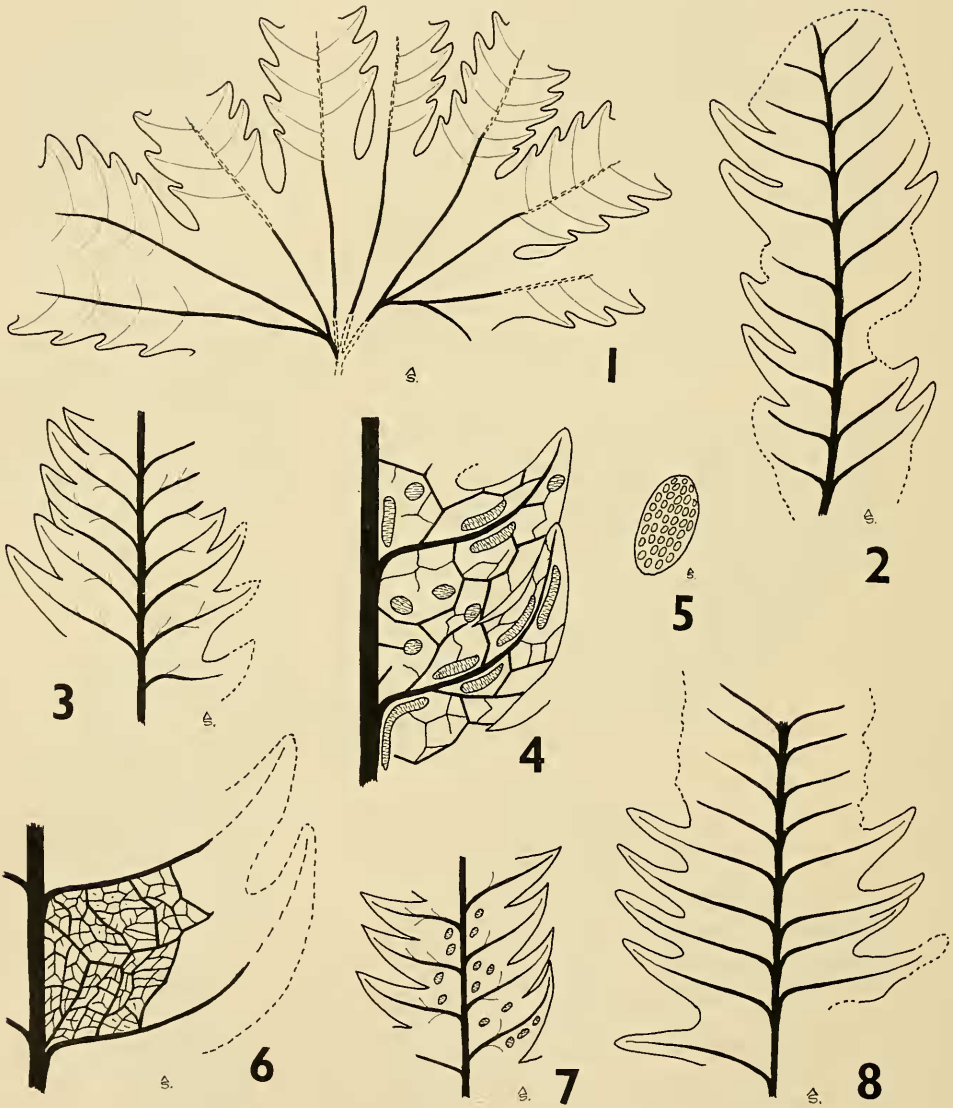

Fig. 3. 1-8 — *Dictyophyllum bremerense* Shirley, 1898 (1) GSQ F549, partly reconstructed ×⅔; (2) GSQ F12041 ×⅔; (3) UQ F2685 ×⅔; (4) UQ F64068 ×1⅓; (5) UQ F64068, sorus showing probable arrangement of sporangia ×6⅔; (6) UQ F43868 ×2; (7) UQ F64068 ×⅔; (8) UQ F2668 ×⅔.

(1898), pl. XIII, fig. 2; Denmark Hill, Ipswich, Qld; Late Triassic age. *Paratype* GSQ F 166, figured by Shirley (1898), pl. XIII, fig. 3; and counterpart UQ F 5981; from the same locality.

Other Specimens: Denmark Hill, Blackstone Formation (upper part of the Ipswich Coal Measures) of Karnian age (de Jersey, 1972): GSQ F 549, 12033-12044; UQ F 2342, 2668, 2685, 5983, 5984, 44313; 5981 (counterpart of GSQ F 166) and 8199 both figured by Jones & de Jersey (1947; pl. 1 fig. 6; pl. iv, fig. 1b respectively).

Dinmore Quarry, Qld, Blackstone Formation: Mr N. Petty's collection nos. 259, 264 a/b, 539, 607.

Ipswich (details unknown), Qld. SUP 20007 a,b.

Dictyophyllum davidii Walkom, 1917

Fig. 1. 7; Fig. 2. 12; Fig. 5. 15-17

1917, *Dictyophyllum davidi* Walkom. *Geol. Surv. Queensl., Publ.* 257: 10, pl. 3, fig. 2.

1924, *Dictyophyllum rugosum* Walkom. *Mem. Queensl. Mus.,* 8:2, pl. 21, fig. 1.

1954, *Dictyophyllum bremerense,* Shirley, in Derrington — unpublished thesis, University of Queensland: 45.

1975, *Dictyophyllum davidii* Walkom, *in* Flint & Gould, *J. Proc. R. Soc. N.S.W.* 108: 71, pl. 1, fig. 3.

Description: Frond palmate, with at least eight pinnae. The leaf is definitely petiolate, the petiole divides once into two main veins, which in turn divide over short intervals giving off four veins each to form the pinnae.

The type-specimen has incomplete pinnae up to 50 mm long by 20 mm wide; in another big specimen they reach 100 mm long by 30 mm wide.

Pinnae are only slightly pinnatifid, with small free "pinnules" only 4-5 mm long; it seems better to describe the pinnae as strongly dentate rather than pinnatifid, First order lateral veins arise at 70-75°, one for each "pinnule" or "tooth", reaching their apex, slightly falcate. Veins of successive order cannot be clearly differentiated; they form a network of polygonal (4-7 sided) meshes. The meshes are somewhat elongated with their main axis parallel to the pinna rachis, but become more isodiametric towards the margins and pinnae apices. The former are around 1.5 mm by 1 mm and the latter about 1 mm diameter.

Only one fertile specimen is available; it shows elongated sori, 1.2-2 mm long by 0.8-1.2 mm wide, arranged mainly along the pinna rachis and first order lateral veins; very occasionally they seem to be on other parts of the lamina. Each sorus contains 25-30 sporangia but no details of these can be made out.

Discussion: This species was believed to be closely related to the well known *Dictyophyllum rugosum* (L. & H.) and was sometimes mistaken with it. But the redescription given by Harris (1961) for this species shows very clearly that *D. davidii* is a different species, with a general morphological similarity. Additionally the soral characters herein described for *D. davidii* very strongly support this difference.

As already stated it is felt that *D. davidii* belongs to a natural "group" of species together with *D. bremerense, D. tenuifolium, D. ellenbergi* and *D. acutilobum.*

Material Studied: Holotype (here designated): GSQ F 165, from "Challivet", portion 28, parish Biarra, near Esk, Qld; Esk Formation of Middle Triassic age, largely Anisian (de Jersey, 1972).

Other Specimens: Esk Formation of Middle Triassic age. "Challivet", portion 28, parish Biarra, near Esk, Qld: GSQ F 168, 933, 12043; Various sites at or around

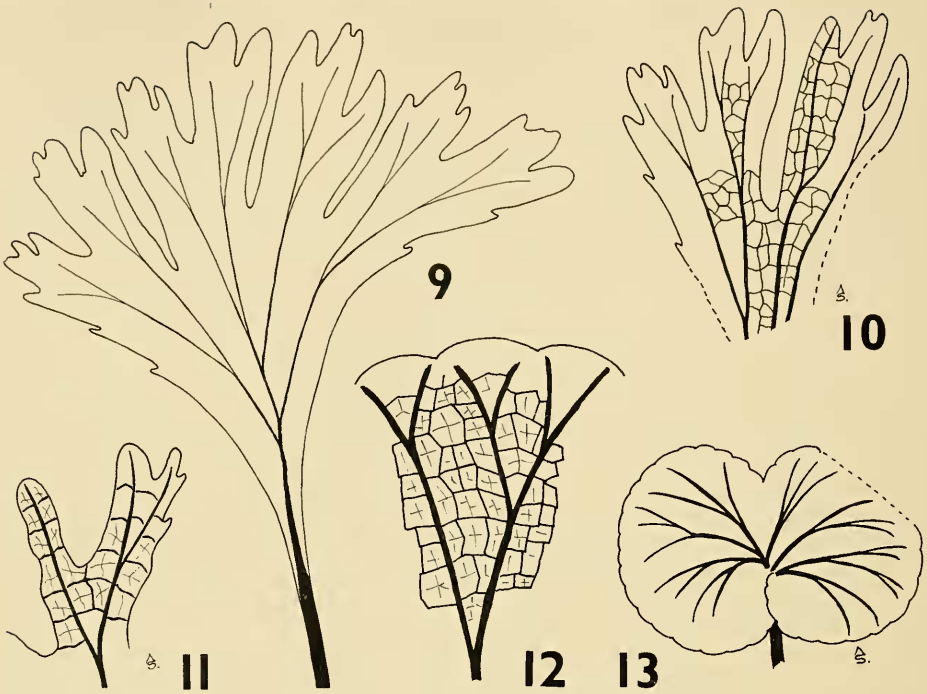

Fig. 4. 9-11 *Hausmannia wilkinsii* Walkom, 1928 (9) GSQ F1943a, combined with GSQ 8857 to give the reconstruction of a leaf ×2⅔; (10) GSQ F1943a, detail of venation ×2⅔; (11) GSQ F8843, detail of venation ×1⅔. 12, 13 — *Hausmannia (Protorhipis)* sp. cf. *H. (P.) deferrariisii* Feruglio, 1937 (12) UQ F50306, detail of venation ×3⅓; (13) UQ F50306, reconstruction of a leaf ×1⅓.

Wivenhoe Hill, parish Wivenhoe, Qld; UQ F 2010, 2046, 2051, 2359, 5812, 12853, 17068, 17069, 26754, 64177. Mandura 1:63 360 map sheet at grid reference 936629 (quoted from Derrington, 1954), Qld: UQ F 17394 a/b. Caboolture 1:63 360 map sheet at grid reference 645257, Qld: UQ F 17079 a/b. Portion 42, parish Wivenhoe, Qld: QM F 1468 (Walkom, 1924, pl. 21, fig. 1).

Bundamba Group of latest Triassic to Middle Jurassic age (Cranfield & Schwarzbock, 1972), horizon within the Bundamba Group unknown. Precipice Creek (tributary of the Dawson River), 4 km SW of Rose's Shack, Qld (Hill, in Shell Report, 1951): UQ F 48643, 48654.

Dictyophyllum acutilobum (Braun) Schenk

1917, *D. acutilobum* (Braun) Schenk, in Arber, E.A.N., *Paleont. Bull. N.Z. Geol. Surv.* 6:34, pl. XII, figs 2-4.

Discussion: I have not seen the original specimens described by Arber, but there is little doubt that they can confidently be regarded as belonging to the species.

D. acutilobum has a rather wide distribution (Sweden, Germany, Persia and New Zealand) and was also quoted, without illustrations, by Zeiller (1875) from the "Rhaetic" of Chile; later Solms-Laubach, while describing plants from the same locality, quoted a different species of Dipteridaceae, but did not illustrate his species.

The fragment found at Purga, Qld, described below is very similar to illustrations

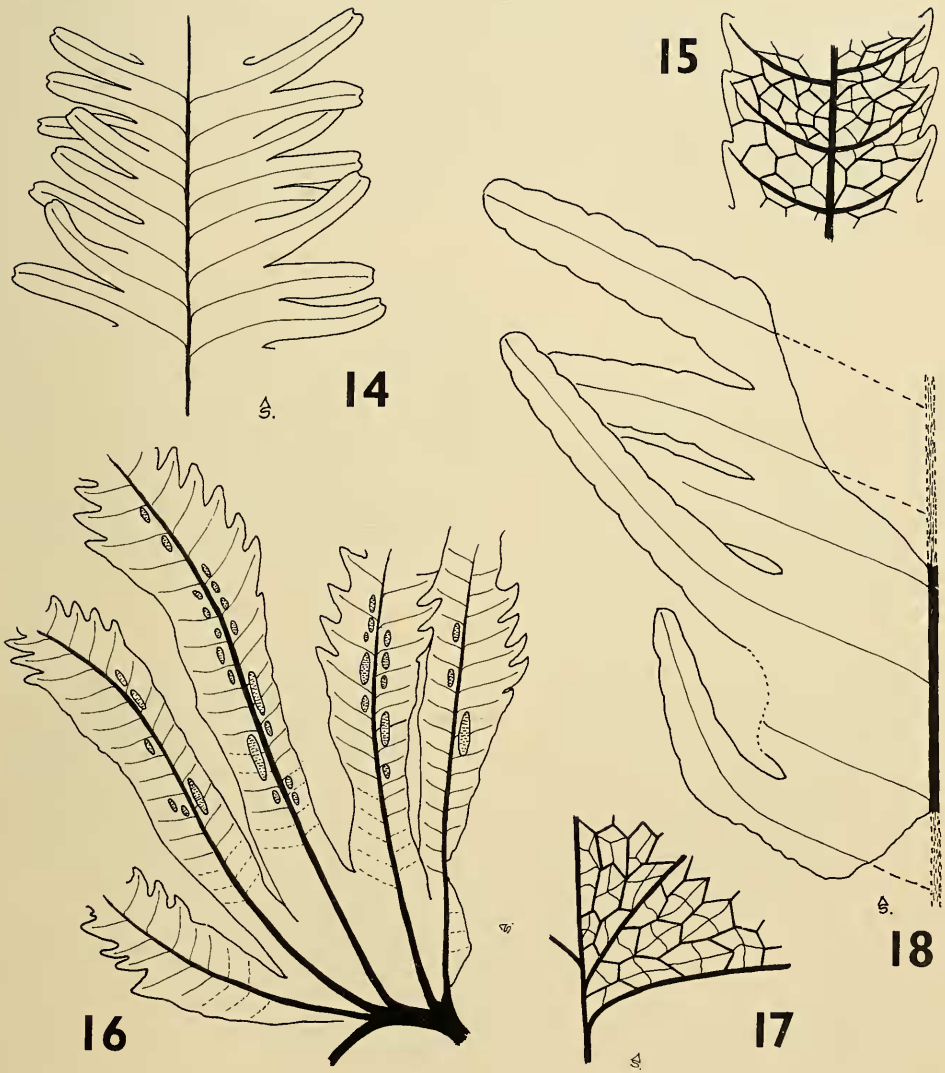

Fig. 5. **14, 18** — *Thaumatopteris shirleyi* n. sp. **(14)** UQ F64280, reconstruction of part of the leaf based on the holotype × ⅓; **(18)** UQ F64280, holotype × 1. **15-17** — *Dictyophyllum davidii* Walkom, 1917 **(15)** GSQ F165, holotype × 2⅔; **(16)** UQ F64177 × ⅔; **(17)** GSQ F165, detail of venation of the holotype × 4.

of this species figured by other authors, and therefore I consider that it most probably belongs here, but because of its fragmentary nature must be regarded as a comparison.

Dictyophyllum sp. cf. *D. acutilobum* (Braun) Schenk

Fig. 6. 16

Description: This pinna fragment is 28 mm long by 20 mm wide with two "pinnules" on each side. These are sub-triangular with a slightly curved midvein arising at about 45° from the rachis, and continuing to the apex of the "pinnules". The free part of each "pinnule" is one third of the total width.

From each midvein, secondary veins arise which, by successive divisions form a network of polygonal meshes. Those of the first order are about 4-5 mm diameter, and are filled with higher order meshes, the smallest one (highest order) are about 0.9-1 mm diameter.

Material Studied: Purga, Qld; Walloon Coal Measures, mainly Middle Jurassic: UQ F 5856.

Thaumatopteris shirleyi n. sp.

Fig. 2. 9, 10; Fig. 5. 14, 18

Diagnosis: The biggest fragment represents a portion of pinna with a strong rachis 2 mm wide. First order lateral veins arise at 30° to enter the pinnules and reach their apex. The lamina forms a continuous wing along the rachis up to 22 mm wide, thereafter the pinnules are free. They are up to 72 mm long by 11 mm wide at the base, diminishing very slowly to 5 mm wide at the rounded apex. A small pinnule measures only 23 mm long by 5 mm at the base. Margins of the pinnules are crenated, each crena slightly asymmetrical, and about 3.5 mm long.

Second order lateral veins (laterals of pinnules) emerge at 40-45°, and are spaced 4-6 mm apart. Those on the winged lamina are immediately dichotomized forming a net of polygonal first order meshes of 7 by 5 mm diameter, with their longest axis along the main rachis. Inside these, successively smaller meshes are formed, the smallest about 0.5 to 1 mm diameter; in many cases a free terminal veinlet in these ultimate meshes can be seen. In the pinnules only the small last order meshes stand out clearly.

All specimens are sterile, but one of them shows some bulgings of the lamina which could correspond to underlying bodies (sporangia?). These bulgings coincide with the interior of the ultimate meshes.

Discussion: I could not find a species among the Dipteridaceae which can be closely compared with *T. shirleyi*. There are several forms with long "pinnules" but the lamina adjoining the rachis, the size and venation characters differ quite a bit.

Although not known from complete leaves, *T. shirleyi* seems to be one of those cases where it is difficult to decide between *Thaumatopteris* or *Dictyophyllum* as the best to house the species; the former name is preferred on account of the above-mentioned long "pinnules".

Material Studied: Holotype: UQ F 64280, *Paratypes:* UQ F 64204 a/b from Dinmore Quarry, Ipswich, Qld in the Blackstone Formation (upper part of Ipswich Coal Measures) of mainly Karnian age (de Jersey, 1972).

Other specimens: CTES-PB no. 2995, University of the Northeast, Corrientes, Argentina.

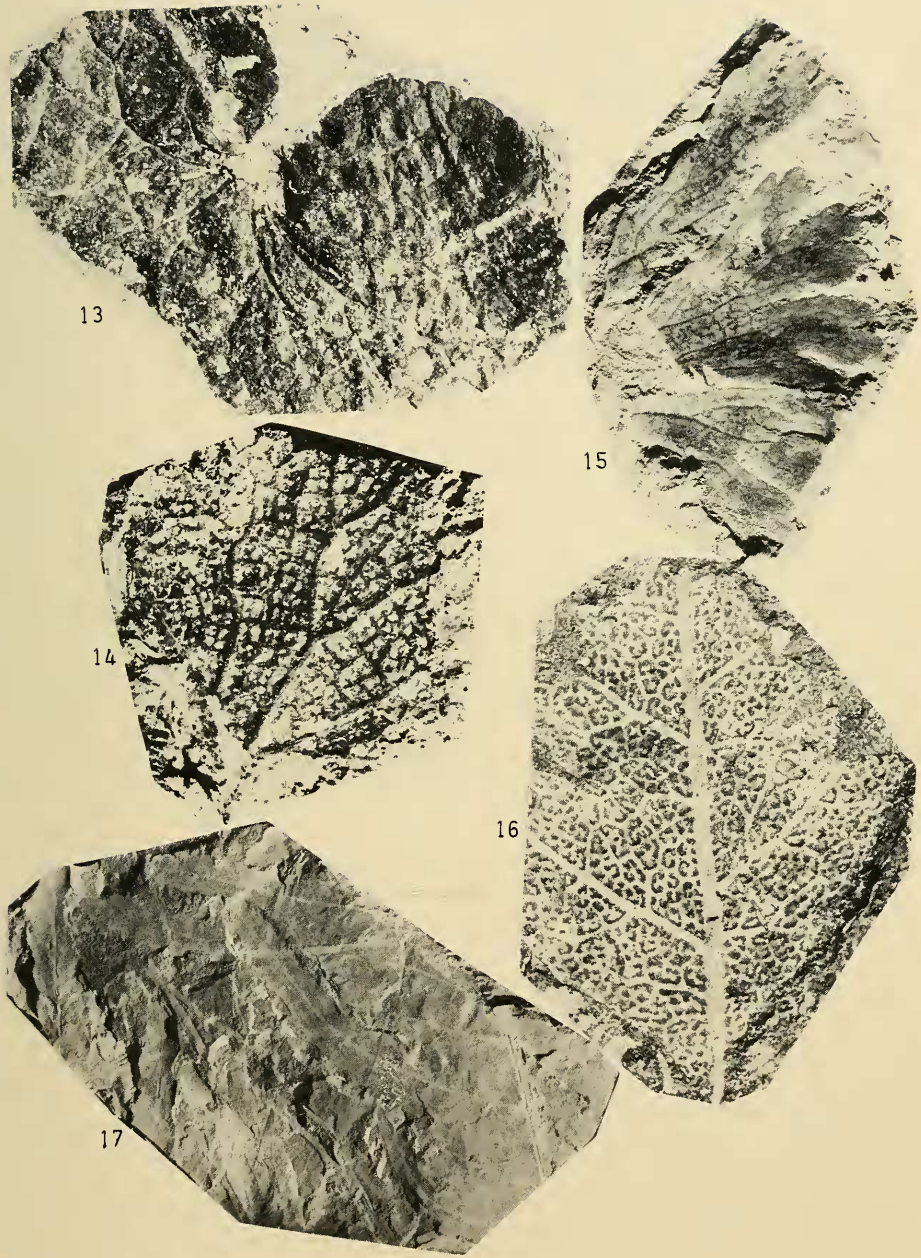

Fig. 6. **13, 14** — *Hausmannia (Protorhipis)* sp. cf. *H. (P.) deferrariisii* Feruglio, 1937 **(13)** UQ F50305 ×2⅔; **(14)** UQ F64201 ×4⅔. **15** — *Hausmannia wilkinsii* Walkom, 1928 GSQ F1943a ×2. **16** — *Dictyophyllum* sp. cf. *D. acutilobum* (Braun) Schenk, 1874 UQ F5868 ×2⅔. **17** — *Thaumatopteris shirleyi* n. sp. UQ F64280, holotype ×⅔.

Hausmannia (Hausmannia ?) wilkinsii Walkom, 1928
Fig. 1. 1; Fig. 2. 11; Fig. 6. 15; Fig. 4. 9, 10, 11

1928, *Hausmannia wilkinsi* Walkom. *Proc. Linn. Soc. N.S.W.*, 53 (2): 148, pl. xiii, figs 3, 4.
1967, *Hausmannia wilkinsi* Walkom, *in* White. *Rep. Bur. Miner. Resour. Aust.*, 1967/78: fig. 3.
1972, *Hausmannia wilkinsi* Walkom, *in* White, *Rep. Bur. Miner. Resour. Aust.*, 1972/1: figs 6, 7.

Description: Complete(?) or half leaf(?) flabelliform, petiolate; the lamina is dissected into four main segments which in turn are again dissected but not so deeply. The four main segments correspond with each of the main veins into which the petiole splits; they dichotomize several times, each final vein reaching the apex of the ultimate portion of the dissected lamina. Veins of higher order arise at right angles and form a network of more or less quadrangular to 5-sided meshes of about 4-5 mm diameter. These are filled with successively smaller meshes, the smallest being about 1-1.5 mm diameter.

Discussion: The few more or less fragmentary specimens of *H. wilkinsii* seem to show that it could be an intermediate form between the classical forms included in the subgenera *Protorhipis* and *Hausmannia* (s.s.) more probably inclined towards the latter.

For its size and venation it was correctly placed in a separate species from those known to Walkom in 1928 and this difference still stands.

Since erected by Walkom (1928), *Hausmannia wilkinsii* has only been used by White (see synonymy) for some fragmentary specimens, which appear to be correctly identified. These specimens came from the Nullawurt Sandstone Member of the Bungil Formation of Early Cretaceous age, and the Gilbert River Formation of Jurassic-Early Cretaceous age, in Queensland.

Material Studied: Lectotype (here designated) GSQ F 1943, from Lower Camp, Plutoville, Cape York Peninsula, Qld, of Early Cretaceous age. Figured by Walkom (1928) pl. xiii, fig. 4. *Paratype* GSQ F 1944, figured by Walkom (1928) pl. xiii, fig. 3.

Other specimens: GSQ F 8843, 8844, 8851, 8857, 8858. All specimens come from the type locality.

Hausmannia (Protorhipis) sp. cf. *H. (P.) deferrariisii.* Feruglio, 1937
Fig. 1. 6; Fig. 6. 13, 14; Fig. 4. 12, 13

1961, *Hausmannia* sp., in White, *Rep. Bur. Miner. Resour. Aust.*, 1961/146 fig. 15.
1966, *Hausmannia (Protorhipis)* sp., in Hill, Playford & Woods, *Jurassic Fossils of Queensland* (Queensl. Palaeontographical Soc.), pl. J1, fig. 9.
1966, *Hausmannia* sp., in White, *Rep. Bur. Miner. Resour. Aust.*, 1966/111, fig. 1.
1974, *Hausmannia* sp. cf *H. (Protorhipis) deferrariisii* Feruglio, *in* Gould, *Proc. R. Soc. Queensl.*, 85 (3): 35.

Description: Leaf entire, composed of two half laminae separated by a deep lower and a short upper sinus. Each half lamina is more or less oval, 20-23 mm long by 15-20 mm wide, margins markedly crenate. The strong petiole, which probably was

originally at right angles to the lamina, gives off four primary veins into each half lamina. Each vein divides dichotomously several times to form a network of more or less quadrangular to hexagonal meshes of successively higher orders, the smallest measure about 0.4-0.5 mm diameter.

The first dichotomy of the primary veins occurs halfway to the margin, and successive dichotomies along the primary veins branch at about 45°. Higher order veins and veinlets branch almost at right angles.

All specimens are sterile.

Discussion: Several good specimens of this species are in the University of Queensland collection, but even so it is difficult to establish definitely their complete identity with *H. (P.) deferrariisii* Feruglio, which was originally described from the Middle to Upper Jurassic of Patagonia. There seem to be slight differences in size and venation characters, as well as considerable geographical separation between localities. As the Australian specimens are not completely identical with the Argentinian ones, the best procedure is to designate a comparison. Gould (1974) adopted a similar procedure.

Some specimens quoted by White (1961, 1966) are too fragmentary to allow a definite determination, however they are most probably Early Cretaceous in age. The specimen originally figured by White (1966, fig. 1; reproduced here as Fig. 1. 6; the photograph was kindly supplied by Mrs White) seems to be fertile. It very strongly resembles *H. (P.) papilio* (Feruglio) Herbst, a closely allied species.

Material Studied: Walloon Coal Measures, mainly Middle Jurassic; Tannymorel Colliery, Tannymoreal, Qld. UQ F 50305, 50306, 64192, 64193, 64194 a/b, 64195-64197, 64198 a/b, 64199, 64200. Mt Elliott Mine, Rosewood, Qld. UQ F 64201, 64202.

Other Specimens: Walloon Coal Measures, mainly Middle Jurassic. Kleinton Clay Pit (via Toowoomba), Qld. QM F 2901. Near Kalbar, parish of Fassifern, Qld. QM F 2905.

Hausmannia (Hausmannia) bulbaformis Douglas, 1973

1954, ?Angiosperm, in Medwell, *Proc. R. Soc. Vict.,* 65: 21.
1969, *Hausmannia* sp. indet., in Douglas, *Mem. geol. Surv. Vict.,* 28: 224; fig. 4, 2.
1969, *Hausmannia* sp., in Douglas, *Mem. geol. Surv. Vict.,* 28: 232; pl. 42, fig. 4.
1973, *Hausmannia bulbaformis* Douglas, *Mem. geol. Surv. Vict.,* 29: 96-97; pl. 33, fig. 3; fig. 7, 44.

Discussion: Only two specimens are available and both are rather fragmentary. Specimen MUGD 3533A, the holotype, from the Koonwarra fish-beds shows some details of venation, thus it can be ascertained that the leaf belongs to the Dipteridaceae, and most probably to *Hausmannia.* It is a petiolate incomplete leaf, with several main veins dividing in a fan-like way which by successive divisions form a network of polygonal, slightly elongated, meshes about 1 mm in diameter. The lamina seems to have been quite thin and filmy.

I think it is rather risky to erect a new species on such fragmentary material, but on the other hand it can be stated that the specimen does not resemble any of the known Australasian species of *Hausmannia.* Therefore I shall provisionally accept Douglas' classification hoping that in the future more findings and better preserved material will justify the erection of this species.

Material Studied: Koonwarra Fish Beds, near Leongatha, Vic.; Wonthaggi 1:63 360 map sheet grid reference 3966, 2457. Early Cretaceous: MUDG 3533 A, B. Killara Bluff, allotment 4, section A, Parish of Killara, Vic. Early Cretaceous: MUDG 2014.

cf. *Clathropteris* sp.
Fig. 1. 4

Description: Fragments of lamina with typical "clathropteroid" quadrangular network of meshes. None of the available specimens shows any part of the original margin, but the biggest one shows what appears to be the main rachis from which at least six first order (?) veins depart in a more or less palmate arrangement. They dichotomize at angles of 45°, and from their branches the veins of successive orders start at right angles to form the abovementioned quadrangular network with meshes about 3-3.5 mm diameter.

Further away from the base, these meshes become more polygonal (5-6 sided), but remain about the same size. The ultimate meshes are about 1-1.5 mm each side, and again quadrangular at the base, and slightly more polygonal away from it.

Material Studied: Cooroy 1:63 360 map sheet at grid reference 098146, Qld; Walloon Coal Measures, mainly Middle Jurassic: UQ F 23068-23072, UQ F 23074-23076.

Discussion: All known fragments are too small and fragmentary to allow a definite classification, but from the few diagnostic characters it can be concluded that the pieces most probably belong to *Clathropteris.*

The venation is different from all other known species hitherto described for Australasia.

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